

June 16, 2004

**TITLE:** Further Discussion Regarding World Trade Center Related Sampling

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**Issue #1: Multiple objectives for a sampling program may include: determining the geographic extent of WTC impacts, and determining the differences in WTC impact as a function of building type as well as previous cleaning efforts.** During the meeting on May 24, some members of the panel seemed to indicate that a study to determine “recontamination” would not be useful. Rather, a study to determine “current extent of contamination” better meets an objective deemed most useful by some members of the panel at this time. Some members of the panel have also been discussing the need to determine if previous cleaning efforts have been successful in ridding buildings of WTC contamination. This may necessitate that in all buildings sampled, information must be obtained on what cleaning and changes in the building infrastructure have occurred. For example, it seems to be useful to determine types of windows on 9/11 and at present; if building exterior and/or interior were cleaned after 9/11, if any sampling was done in the building after 9/11, if so obtain results; if HVAC system was cleaned or modified after 9/11; what the current status of HVAC system is. Finally, there may be relevant differences in the presence of WTC dust as a function of building type, and this may be investigated in a sampling program.

**Issue #2: The ability of this program to evaluate current contamination status relies on the existence of a validated method for identifying a World Trade Center signature in samples.** Some members of the panel have indicated that the purpose of the sampling should not be to evaluate general indoor contamination (i.e., other than WTC contamination) of buildings in Lower Manhattan and elsewhere. Therefore, a program based only on measuring WTC contaminants that are also urban contaminants, such as asbestos, dioxin, lead, and other contaminants known to be associated with the collapse of the towers and the ensuing fires, but also known to be normally found in urban settings, would not be informative. Rather, the foundation of the sampling program must be to develop a method that unambiguously identifies dust as having originated from the collapse of the WTC Towers. Some members of the panel are not comfortable with the use of asbestos air sampling for this purpose. The WTC signature subgroup is currently grappling with the development of a WTC signature for dust and for combustion products and will report back to the panel on its findings. As an overview, key questions include: 1) what exactly is meant by a “validated” method, 2) what are the tests that must be conducted to validate the method, 3) what is the timetable and cost for such validation, 4) does the presence of a WTC signature in a sample also imply the presence or elevation of other WTC contaminants – i.e., how well will the

WTC signature serve as a surrogate for other WTC contamination, and is the surrogacy issue even relevant here? While some members of the panel have emphasized the importance of the signature, the question has also arisen as to whether absence of the signature in an environmental sample is proof that WTC-related contamination also is not present.

**Issue #3: Does “presence of WTC dust” equal “contamination”, and if so, then what?** In their discussions, some members of the panel have implied that WTC “contamination” is evidenced by the WTC signature. In reality, results from a sampling program using a validated method may yield results that range from no presence to faint presence to strong presence of a WTC signature. Does “presence” equal “contamination”? Or, alternately, is a location contaminated only when the measurement exceeds some health-based benchmark? There has been little, but some, panel discussion surrounding the need to attach a health impact interpretation to all measurements. In conducting a sampling program to document the ongoing impact of the collapse of the WTC towers on the indoor environment, consideration must be given to a potential finding of a “significant elevation” (as yet undefined) of measured contaminants, whether or not those measurements can be attributed to impacts from the WTC. Logically, a response to a significant finding could be some measure of cleaning. Does it make sense to clean an entire building if one measurement comes up with such results? Do you clean only the area near the sample? Do you instead base decisions on building clean-up or other building-specific activity based on some aggregation of samples (i.e., average concentration from all samples within a building)? If the strategy is to clean only when measurements exceed benchmarks, then there is the distinct possibility that some samples may suggest the presence of WTC dust or other WTC COPC, but that no clean-up is warranted because the levels are low. What is each panelist’s opinion on this approach? Further, maybe it’s most appropriate to aggregate samples not only within buildings, but even further to aggregate all samples within geographic zones to make judgements and observations about the zone, and not base any decisions on building-specific or sample-specific results. Do you leave any decisions regarding clean-ups or further activities out of the study design phase entirely, and simply sample, analyze the results, and share the results with the public and panel for further deliberation? In the longer term, what are other “follow-up” activities to this initial sampling effort?

In any case, it would appear that health-based benchmarks would be useful in some context for the interpretation of measurements taken in a sampling program. The health-based benchmarks as developed by Region 2 for the Clean-Up Program could be retrieved for current purposes. For air, indoor benchmarks were developed and peer reviewed for asbestos, lead, PAHs, dioxin, silica, and MMVF, and for settled dust, benchmarks were developed for lead, dioxin, and PAHs. Draft benchmarks were also developed for asbestos, silica, and MMVF in dust, but based on peer review comments, these benchmarks were dropped. These could be retrieved for current purposes, if necessary.

With these issues as backdrop, features and issues of a sampling design can now be identified and discussed.

**1. Are “buildings” are the unit for sampling?:** For the original design discussed by the panel members for evaluating recontamination, the apartment was the unit for sampling. The sampling design called for 3-5 air samples, depending on the size of the apartment. Given that the 8-hour air samples were an effective integration of the air quality within the room that the sampler was set up in, one was confident that the 3-5 samples taken adequately characterized the apartment with regard to asbestos.

Challenges arise when considering a new study that may focus on a unit other than an apartment. Some members of the panel have suggested that the appropriate unit is a “building”. Deciding how to represent a “building” with a sampling design is anything but straightforward. How does one guarantee adequate coverage within a building, short of committing to sample a very large number of “spaces” within a building? Does one instead choose to define “spaces” within buildings as the sampling unit? Such spaces could include common spaces, full apartments if the building is an apartment building, office spaces if the building is an office building, or other spaces. The appropriate means to characterize a “building”, or “spaces” within buildings, could be a function of building type, building size, cleaning history, funds available, and similar measures. The “building” sampling could also include HVAC sampling. Proper characterization of the role of the HVACs in recirculating WTC contaminants is another challenge for this study. It is also not clear generally where in buildings it would be appropriate to sample: in heavily trafficked (and likely heavily cleaned) areas? in cracks/crevices and similar locations where exposure is not likely to occur but where cleaning is also not likely to have occurred? In fact, John Kominsky, who provided expert review comments on the issue of the use of asbestos as a surrogate, endorsed this latter notion of seeking out “cracks/crevices” as he made the recommendation that (and his recommendation assumed that the new program involved air sampling), “the resampling protocol includes specific direction to ensure that any residual material in ‘hidden or not readily accessible areas’ be sufficiently disturbed and re-entrained in the air stream of the apartment.” For dust sampling, this might translate to specifically locating dust in obscure areas such as behind furniture, underneath rugs, above cabinets, and so on. The issue with such an approach is that the results cannot be related to any health based benchmark. How can this issue be addressed?

**2. Plan to sample only public buildings, while sampling private buildings on an “opportunistic” basis:** Access to buildings for sampling has been acknowledged as a logistical issue for this study. It has been suggested that common areas in apartment buildings would be a good location for testing that would also offer minimal disturbance to apartment owners. However, as has also been noted, common areas might be among the areas most carefully cleaned in apartment buildings. It was also suggested that participation will not be as difficult within public buildings such as firehouses, schools, government office buildings, and other public building locations. Private buildings can be included on an opportunistic basis, meaning that they would be included if so desired by the building owners, or apartment owners if within apartment buildings. This is where the public participation workgroup can work to ensure sufficient participation by private buildings in the sampling program by enlisting participants.

A sufficient number of buildings should be sampled so that the results are representative of the areas sampled. In some manner, not only the number of buildings but how they are selected should have a sound statistical basis. For example, once the number of buildings to be sampled is determined a randomly generated grid can be created and the public buildings nearest the node points can be selected for sampling (see more discussion below).

**3. Take extensive or limited air sampling in conjunction with dust sampling:** It may be informative and otherwise useful to be taking air samples in conjunction with all or some dust samples. Possible multiple uses of the air sampling include: 1) analysis of air samples could be held off and triggered based on measurements in the dust; alternately, they could all be measured up front; 2) the dust samples could be considered as most appropriate for WTC signature identification while the air samples could be most useful for comparison with the peer-reviewed health-based benchmarks (inhalation has always been considered the most direct route of exposure); 3) it would be of scientific interest to study the correlation between occurrence of WTC contaminants in dust and then in air; and 4) it could potentially answer the question of recontamination.

**4. Specifically identify contaminants for sampling analysis:** During the sampling program, which contaminants, if any and in addition to the signature(s), should be sampled for analysis? Only two of the five asbestos-as-surrogate expert reviewers advocated measuring for lead as well as asbestos as surrogates for World Trade Center contamination, and the one reviewer most strongly advocating for analysis of lead also strongly recommended follow-up for identification of the source of lead if it was found to be high in the samples. Like lead, dioxin is a ubiquitous urban contaminant. It was only found at elevated levels indoors in the Region 2 Clean-Up Program in 8 wipe samples of 1500 taken in 262 apartments which had wipe sampling conducted in addition to the air sampling. Further, dioxin analysis is perhaps the most expensive of all the COPCs, in the range of \$1000 per sample. Should these COPCs or others not be included in further indoor sampling?

**5. There is a need to better define the scope of the study at this planning stage:** Some members of the panel has been discussing notions such as “screening” and “phases” when discussing a sampling plan. However, these terms are somewhat diffuse and can have different implications for study design. For example, one possible “screening” approach would be to sample a small number of buildings most likely to be contaminated, and if they are not contaminated, than one can halt all further sampling on the presumption that if the buildings most likely to be contaminated are free of contamination, than all other buildings are also going to be free of contamination. The concept of screening can also be applied to the samples themselves. Enough sample volume (and maybe air in addition to dust) can be taken to measure for a host of contaminants, but the first analysis will be only for the “signature”, and if the signature is not found, than measurement for other COPC may not be warranted. “Phases” of study have been discussed in terms of sampling perhaps at first only in buildings near Ground Zero for Phase 1, and then moving to further locations such as Brooklyn or Chinatown

for a Phase 2. Further consideration may be given to these and perhaps other related concepts in order to better define the scope of a sampling plan.

**6. Begin the process of scoping out a complete sampling plan:** Based on the talking points above, following are some thoughts on study design:

**Purpose:** The purpose of the sampling plan must be clearly and specifically defined. One possible purpose could be to define gradient of COPC with respect to WTC. By starting the sampling near Ground Zero and moving outward, it may be possible to demonstrate the trend of declining COPC concentrations in buildings as one moves further away from Ground Zero, or alternately, demonstrate that no trend exists.

**Building Selection Procedure:** The method for selecting buildings to be sampled must also be specifically identified. One possible selection procedure could be to separate the study area into “zones” and strive to characterize buildings in these zones. The number of buildings, and the number of samples per building, can be determined based on statistics, best engineering judgement, “opportunistically” as in volunteer participation for apartment buildings and office buildings, funds available, other criteria, or some combination of criteria. The zones that were advocated in the previous discussion paper, census blocks, could be used here or a different zone concept could be developed. Once zones have been delineated, one can overlay a grid which would facilitate a statistical random selection procedure for building. The public buildings (schools, firehouses, police stations, post office, Federal, state and city government buildings) and any “volunteer” non-public buildings nearest to randomly generated grid locations can be selected for study. If possible, statistics could assist in determining a minimum number of buildings that would need to be sampled in order to appropriately characterize the zone.

**Building Sampling Procedure:** Much detail has to be worked out here, but some of the ideas discussed above include: sampling air alongside dust samples, sampling to evaluate the possible role of HVAC in recirculating COPC, sampling in a variety of locations ranging from heavily trafficked areas to obscure locations where WTC dust may remain, and so on. The most important feature of a “building sampling plan” is to be confident that the sampling will adequately characterize the building for purposes of this study.

**Data Analysis/Interpretation Procedures:** Similarly, much detail needs to be worked out before the first sample is taken. It is unclear whether the previous experience with apartment sampling and clean-up has relevance to the current design. Recall that a single measurement of asbestos above the benchmark (or inability to measure asbestos because of a clogged filter or other analytical problem) led to an offer for an apartment cleaning or recleaning. Similar clarity of intent and objectives is currently lacking for the current efforts at sampling and analysis. Many of the issues identified earlier in this discussion paper need resolution, so that post-survey data analysis and interpretation can proceed effectively.